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ANALYSES.

I.—*Travels through the Alps of Savoy, and other parts of the Pennine Chain; with Observations on the Phenomena of Glaciers.* By James D. Forbes, F.R.S. Ed., F.G.S., Corresponding Member of the Institute of France, and Professor of Natural Philosophy in the University of Edinburgh. Edinburgh: A. & C. Black; London: Longman, Brown, Green, & Longman. 1843. [By the Editor.]

It is, we believe, generally admitted that Professor Forbes has by this work, and also by his papers in the Edinburgh Review, and various scientific journals, contributed materially to promote the development and rectification of the theory of glaciers. It is, however, as a contribution to positive geography that we propose to examine the volume now before us. And in this point of view its importance will be found to be scarcely, if at all, inferior to those attributed to it as a work of speculative science.

Professor Forbes, in his 'Travels,' reads an important prudential lesson to geographers, though this does not appear to have been one of his objects in writing.

It is evident, from many incidental remarks, that the best modern maps of the Pennine Chain of Alps are lamentably in error. "One would hardly guess," he says at p. 216, "from the common maps, that Mont Blanc and its adjacent tributaries* form a kind of oval group, rather than a portion of a line of mountains continuous from the Mediterranean to the Tyrol." At p. 270 he says, "I have not met with a description of the Col des Fenêtres in any work." At p. 289, adverting to the almost unknown lateral valleys which open into the Rhone valley at the well-known stages on the Simplon road, Sion, Sierre, and Tourtemagne, he observes:—"His [Fröbel's] work is valuable, from an improved map which it contains, and which corrects many of the almost incredible errors of the best executed maps before that time [1840], such as those of Weiss, Keller, and Wörl." At pp. 303 4 some startling errors of Wörl, Keller, and Von Welden are specified. And at p. 350 we meet with the following explicit passage:—

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* This is a strange expression: "tributary streams," though a figurative expression, which has introduced much vagueness into geographical description, is intelligible; but "tributary mountains" is a phrase to which no idea can be attached.—Ed.

"I must say a word here respecting the maps of this country [the vicinity of Zermatt], which are worse than those, perhaps, of any other part of the Alps, and are all nearly equally bad, though with a great diversity of errors, which, showing that the artists have copied neither nature nor one another, leaves us to consider them as pure fabrications. Thus, in the map of apparently most authority of any—Von Welden's—attached to a work professedly geodetical and topographical, whilst the Italian side of the mountain [Monte Rosa] and its valleys are neatly and well laid down, the northern or Swiss side is a mass of pure invention, in which the most obvious features are nowhere to be found, and villages and glaciers, lakes and mountains, are jumbled into inextricable confusion. Take the easily accessible neighbourhood of Zermatt:—The great glacier of Gorner is to be recognised only by its name (Zermatt Gletscher), and *debouches* on a lake which has no existence; the Riffel and the glacier of Zmutt are nowhere! Nor is the valley of Saas better. The Matmark See, a lake below Distelberg, is supplanted by an imaginary glacier, composed of tributaries from all sides, and across which the path of the Moro is carried. A very pretty and detailed map of the Simplon pass and its neighbourhood, published by authority, replaces the great glacier of Macugnaga by a great lake! Wörl, in his map, has copied Von Welden's errors. Even the new government map of Sardinia, of which a sheet has lately appeared, has perpetuated blunders even worse than those of Von Welden's, and in exquisite engraving. Lakes are created, villages are displaced, and others which have no existence inserted where glaciers should be! The Italian side is, however, admirably executed, even though not quite precise in the details of roads and villages. On the whole the most careful map of the Swiss part of the chain is that in Engelhardt's work;* but the author has unfortunately adopted a complex and impracticable system of projection, partly picturesque, partly geometrical, which greatly diminishes its value. I cannot help thinking, also, that in this, as in other maps, the breadth of the Saasgraat is underrated at its upper part. It is a very pretty, though certainly not an easy topographical problem, to unravel the complications of this chain, of which the mountains are so inaccessible, so varying in their forms, and each called by several different names."

Now, it is not creditable to European geographers, that at a time when every day adds to our intimate knowledge of the Ural and Caucasus, of the Bolor-tag, the Altai, and the Himmalaya, and of the mountain masses of America, such ignorance and confusion should prevail regarding the mountain mass which may be regarded as the central knot of the upheaving of the European continent; and which, at no great distance from Paris, London, and Berlin, has Vienna and Munich at its northern, Venice, Milan, and Turin at its southern, and Geneva at its western base. Much harm has been done in geography by the adoption of systems of classification and technical phraseology based upon mere topographical observation. But infinitely more mischief may be the consequence of the vague and superficial notions which must result from exclusive attention to numerous hasty and necessarily superficial observations collected from all quarters. The contributions to geodetical science, from European travellers over the distant and colossal protuberances of the earth's surface which have been alluded to, can only be turned to account by him who has carefully studied those forms which are accessible to his own observation. It is in the Alpine regions of Europe that the European geographer must collect those preliminary notions, by the aid of which alone he can rightly understand and turn to account, in his department of natural history, the important facts gleaned by travellers in more remote regions. The account given by Professor Forbes of the wretchedly deficient knowledge of a portion of the European Alps so limited in extent, situated in such proximity to the principal resorts of European science as the Pennine chain, betrayed by the most recent maps, show that this maxim has been entirely disregarded; that the geographers of the present day are more intent upon accumulating materials than upon working them up into solid, consistent, and artistically finished systems. Yet it is only as materials for such systems that our accumulations of isolated facts, diffusely and verbosely expressed as they frequently are, can be of any value.

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* "Schilderungen der höchsten Alpen," 1840.

The statements of Professor Forbes respecting the geography of the Pennine chain supply a startling illustration of this truth. But they relate unfortunately to isolated cases of remissness in the attempts of European geographers to advance the knowledge of their own continent. Valuable materials have been accumulating for nearly half a century, and are still accumulating. Surveys of the principal European states, by skilful engineers, aided by the most recent and improved instruments, have been made or are in progress. The labours of De Luc, Saussure, Tralles, Humboldt, Von Buch, Struve, De Beaumont, and other distinguished scientific men, have gone far to prepare materials for a practical and comprehensive classification of the European local forms of the earth's surface. Yet no attempt has been made to extract from all these materials an improved geography of Europe. The surveys of each state, when they have been used by our map-makers, have been adopted, without any critical examination as to how far they were coherent with each other—whether the impossibility of bringing their *termini* to coincide did not imply errors in one or all. The discrepancies which exist in different parts of the same survey have not been adverted to. And our descriptive geographers have equally neglected to avail themselves of the observations of De Luc and Murchison, Saussure, Von Buch, and our author, with a view to improve their systematic accounts of European geography. The accumulation of materials confuses and depresses rather than instructs, for the want of some one to select and arrange systematically what is essential in them. With such a storehouse of truths accessible, old errors are repeated, or mixed with truths picked up at random in a manner only calculated to increase confusion. The few who have attempted to improve European Geography have failed, from attempting to patch up old clothes with new cloth. The whole system must be remodelled: it is of no use to engraft a few isolated truths upon a system essentially erroneous.

We turn, from the considerations suggested, not expressly stated by our author, to pass in review his positive additions to our knowledge of the local forms of the European Alpine mountain mass, and their arrangement. In this part of our task we shall, as frequently as it is possible, allow him to speak for himself. His observations are confined to "that part of the Alpine chain called by the ancients the Pennine Alps, a term of doubtful origin, but which it is convenient to retain, as having no modern synonyme. It extends from the Col de Bonhomme, on the west side of Mont Blanc, to Monte Rosa inclusive, thus comprising the highest ground in Europe, and the two most colossal mountain groups." This is but a small portion of the great central elevation of Europe, which occupies the space bounded by the valley of the Po on one side, and the valleys of the Danube, Aar, and Rhone on the other. But to compensate for this Professor Forbes has gone over his ground repeatedly with perseverance, unremitting attention, and, above all, with the zeal which animates a man engaged in a labour of love.

> "It is now," he says, "a good many years since I proposed to myself to travel, not as an amusement, but as a serious occupation, and with De Saussure before me as a model. I have reason to be glad that circumstances, by postponing its execution, led me to appreciate more fully the difficulties of the plan, and to come to its fulfilment, after some experience, with moderated views of ultimate success. The habit of observation, I have already observed, is of slow growth—to use opportunities we must prepare to seize them. I had the advantage of receiving my first impressions of Switzerland in early youth, and I have carefully refreshed and strengthened them by successive visits to almost every district of the Alps between Provence and Austria. I have crossed the principal chain of the Alps twenty-seven times, generally on foot, by twenty-three passes, and have of course intersected the lateral chains in very many directions. . . I have spent a part of ten summers on the Continent, and six of these in the Alps and adjacent country. I have thus repeated my visits to the same spot, and, without almost any exception, I have found more to enjoy, to admire, and to learn on the renewal of my acquaintance with it. Most of the places described in this volume have been visited twice, and several of them in four different years."

It ought to be added, that the author's physical pursuits leading him to determine repeatedly the elevation and geographical position of the places at which his observations and experiments were made, as also to take into account the most delicate and the most frequently recurring natural phenomena, as well as those adapted to arrest attention by their rare occurrence and striking character, were admirably calculated to engrave the express character of the country upon his memory and imagination. There is every reason, therefore, to believe that his descriptions of it are as accurate as they are vivid.

The region of which he gives an account, it has been already intimated, comprehends the Mont Blanc group to the W., and the group called Monte Rosa to the E. We shall first notice his descriptions of these two *termini*, and afterwards what he says of the intermediate chain.

Mont Blanc, and the mountain group of which it forms the centre, is, according to Professor Forbes, of an oval form. "In length this group extends from the Col du Bonhomme, on the confines of the Tarentaise, to the Mont Catogne, in the valley of St. Branchier, above Martigny, a distance of thirty English miles in a north-east and south-west direction; whilst its breadth, at right angles to the former, from Chamouni to Courmayeur, is only thirteen English miles." The natural limits of this group are defined with great precision. On the N.E. is the valley of the Drance, and on the S.W. the Col du Bonhomme. Along the base which fronts to the S.E., are the deep valley of the Allée Blanche, its continuation to the N.E., the Piedmontese Ferret, and the Swiss Ferret, separated from its namesake by the Col de Ferret. At the N.W. base are the valleys of the Arve and the upper valleys of its affluent, the Bon Nant, which joins it from the valley of Montjoie.

The S.E. side of the group is the more imposing in its appearance. We take Professor Forbes's description of it, as seen first from the S.E. and afterwards from the N.E.:—

"From the top of the Col de la Seigne,* the extent of the Allée Blanche is well seen, with the great masses of the chain of Mont Blanc, which bounds it on the left. Mont Blanc itself presents a singular appearance in this direction, and would not be easily recognised by those who know it only in a northern and eastern direction. The western (?) and southern faces are very steep, although not so absolutely precipitous as they would appear to be when viewed in front. The former falls abruptly to the Glacier du Miage; the latter in the direction of the Cramont, into the Allée Blanche itself. The bottom of the valley is here not more than 4000 feet above the sea; consequently this colossal mountain rises above it at a very short horizontal distance, and no less than 11.700 feet of vertical height, which, though not an unbroken precipice, is composed entirely of steep and savage rocks, upon which the snow cannot lie for any extent. Its aspect is, therefore, far more imminent and imposing than on the side of Chamouni, where the eye is greatly deceived as to the actual distance of the top, and consequently as to its height. But here the details rather aid the perspective, and, when seen in profile from the Col de la Seigne, the stupendous buttresses, by which the mountain is supported, and especially one prodigious aiguille of granite, called Mount Peteret, come out in relief, although, when a front view is taken from Courmayeur, or its neighbourhood, their pinnacles, thousands of feet in height, are lost against the towering mass behind, which there seems to rise like a wall. I am unable to state the exact line of junction of the limestone with the central mass of granite. I apprehend, however, that it runs from some way to the N. of the Col de la Seigne (which is calcareous) to the Cime des Fours, and so down nearly to Nantbourant, leaving the Aiguille du Glacier, and the greater part of Glacier de Trelatête, within the primitive boundary. To the E. the limit is in a good measure determined by the direction of the Allée Blanche, which separates for some distance the granite from the limestone. Two conspicuous summits, however, which appear near the foreground of the view, a little higher than the Col de la Seigne, are the Pyramides Calcaires de l'Allée Blanche of De Saussure. They are upon the left hand on descending. It is a walk of nearly five hours from the top of the Col to Courmayeur, during which we traverse the whole length of the Allée Blanche. It is there met by another parallel valley, which opens exactly opposite to it, and forms as it were the prolongation of the Allée Blanche for about five hours farther. This is called the Val Ferret, and terminates at the Col Ferret."

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* The crest of this pass is 8422 feet above the sea: it connects the Mont Blanc group with the range which separates the head waters of the Po from the affluents of the Lower Rhone.

Let us now complete this picture by looking back at the S.E. side of Mont Blanc from the opposite termination of the prolonged Allée Blanche, and then casting a glance down the Swiss Val Ferret:—

"The view from the Col Ferret, looking back, is certainly one of the finest which I have seen. The prodigious outworks which sustain the mass of Mont Blanc on the southern side are more conspicuous here than from any other point, especially the Mont Péteret, which stands out like a majestic Gothic pinnacle. From hence, as from the Col de la Seigne, we see how far this side of the chain is from being an absolute precipice, as it appears when viewed in front as from the Cramont. The descent of the Swiss Val Ferret to Orsières offers no great interest, and is of most tedious length."

That part of the N.W. side of the Mont Blanc mountain group which rises from the valley of Chamouni, and the valleys of the confluents of the Bon Nant, present little that calls for especial notice in a brief *résumé* like the present. The Col de Bonhomme, at the S.W. termination of the group, connects it with high land prolonged nearly in the direction of its axis of greatest elevation, and forming a watershed between the Isère and the Rhone immediately above its junction with that river. The high elevations of the group terminate here, and this accounts for the stormy character of the Col de Bonhomme, thus adverted to by Professor Forbes:—

"The passage of the Bonhomme is one of the most dreary in the Alps; and in bad weather is dreaded by the guides. The strong west wind spends itself upon this great outline of the chain of Mont Blanc, and raises the snow into fearful eddies, called *tourments* in the French, and *guxen* in the German Alps, which are justly feared by those who are exposed to them. Here two English travellers lost their lives some years since. Their last entry is still to be found in the traveller's book at Nanthourant. I have crossed the Col de Bonhomme three times, and on one of these occasions, having merely a porter with me who did not know the way, we got bewildered in fog among the rocks, from which we were only extricated by my referring to the map and compass, instead of following the directions of my companion. When the summit is gained, a wide view is seen over the valley of the Tarentaise; and the traveller naturally thinks of descending immediately by a path right before him. Let him, however, beware of this, for it will lead him into the valley of Beaufort, which is most likely not his intended route. If going to Courmayeur, he follows an ill-traced path on his left, over black shale (or snow during part of the season), which conducts him nearly on a level, after a quarter of an hour's walk, to a point somewhat higher than the last, which is called La Croix du Bonhomme, and which on my last journey I found to be 8195 feet above the sea. The view from thence is striking, although Mont Blanc is concealed, the mountains of the Upper Isère, stretching away towards the Mont Cenis, are fully in view; and conspicuous among them is the Aiguille de la Vancise, a snow-clad pyramid between Moutier and Lans-le-bourg, and which is undeniably one of the most elegant mountains in the Alps."

From this tracing of the base of Mont Blanc it is evident that it ought to be considered as one independent mountain group. The high land which forms its prolongation S.W. of the Col de Bonhomme nowhere attains to the elevation of the central group, and terminates in the angle between the Isère and the Rhone. Mont Catogne, the N.E. termination of the group, has no connexion with any other group or range. With the range of which Mont Cenis forms a part Mont Blanc is connected by the Col de la Seigne; and with that of which the great St. Bernard forms a part by the Col Ferret; but the direction of its axis of greatest elevation does not coincide with either, nor do their axes of greatest elevation coincide with each other. All three are independent systems having only this in common, that they rise from and furrow the same great plateau, or protuberance of the earth's surface. The passes by which the mountain group of the Mont Blanc can be crossed are few and difficult:—

"The Col du Géant offers the shortest passage from the Allée Blanche to the valley of Chamouni. It forms the crest of the chain, where the western branch of the Mer de Glace takes its rise; and, notwithstanding its immense height, it would probably be frequented but for the dangers of the glacier on its northern side. A tradition, common to this and many other passes of the Alps, states, that formerly the glacier was less formidable, and that communication was not unfrequent between Chamouni and Courmayeur. This has not occurred, however, within some centuries from the present time. The passage of the Col du Géant appears to have been reckoned impracticable as late as 1781. M. Bourrit, writing in that year and speaking of the aspect of that branch of the Mer de Glace of Chamouni called the Glacier de Tacul, says with respect to the crevices:—‘ Elles sont si effroyables qu'elles font désespérer de retrouver jamais la route qui conduisait à la Val d'Aoste.”* De Saussure, in the second volume of his travels, speaking of the Glacier de Tacul, does not say one word of this historical passage of the Alps, though he seems to have thought it just possible that the summit of Mont Blanc might be gained in this direction;† and in the fourth volume, written some years later, when about to give an account of his memorable residence on the Col du Géant, he speaks of ‘ la route nouvellement découverte’ from Chamouni to Courmayeur. This was in 1728.

“ There is said to be a passage which has been effected from the Glacier du Miage, which penetrates very deeply indeed on the south side of the chain of Mont Blanc, to the valley of Contamircs, by the glacier also bearing the name of Miage on the north side: but I have no accurate information of its accomplishment, and the appearance of the head of the glacier on the south side gives little encouragement to the attempt.

“ One other passage of the chain has, however, been made, and that is by the glacier of Le Tour, near the Col de Balme, descending by the glacier of Salena into the Val Ferret. This was discovered a few years since by a guide of Chamouni named Mounier.

“ Such are the only known passes of this wild country.”

The pass by the Col du Géant Professor Forbes accomplished in one day. He started from Courmayeur at ½ past 1 A.M., and reached Montanvert ¼ before 4 P.M. His guides descended to Chamouni the same evening, “ where their arrival created some astonishment, as no one had before crossed the Col du Géant in a single day, and as it was supposed that the fresh snow would have rendered the attempt impracticable.” The observations made on this occasion on the Col du Géant gave the following results:—

——“ whence the height of the Col du Géant above Geneva is 9803 feet,‡ above the sea 11,146, above Courmayeur 6979. The Col du Géant, by observations at the Montanvert on arriving there, is 4841 feet above that station. This result we shall afterwards find to agree with the direct comparison with Geneva, and hence we are disposed to place the Col du Géant at 11,146 feet above the level of the sea. De Saussure obtained it trigonometrically, by reference to Chamouni, using the Aiguille du Midi as an intermediate point seen from both, and taking the barometrical height of Chamouni, he determined for the Col du Géant 1747 toises, or 11,172 English feet. By his seventeen days' barometrical observations, compared with simultaneous ones at Chamouni, he obtained by the formula of Trembley, 16 toises less, reducing the height to 11,070 English feet. I have recalculated his simultaneous observations at the Col du Géant and at Geneva, and have obtained so low a result as 11,028 feet."

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* Bourrit, *Voyages*, i., 72.

† § 629.

‡ Calculated both by Baily's tables and those of the French *Annuaire*.

In addition to these investigations of the form and structure of the Mont Blanc group, Professor Forbes has executed a trigonometrical survey of a portion of the system of glaciers situated on its north-western declivity. The ground-plan of the glaciers surveyed is nearly a triangle. One side is formed by the crest of the group from the Col du Géant rising from the Allée Blanche, to the Montagne des E'boulements rising from the Val Ferret; the second passes a little to the E. of the summit of Mont Blanc down to the termination of the Glacier des Bois in the valley of Chamouni, and the third extends from that part to the Montagne des E'boulements. A list is given of the Glaciers on the N.W. side of the group, between the Glacier des Bois and the Col de Bonhomme, accompanied by brief descriptions. We have also accounts of excursions on the principal N.W. glaciers between the Glacier des Bois and Mont Catogne, illustrated in the case of the Glacier d'Argentière by an eye-sketch. Lastly, we have notices of the Glaciers on the S.E. side of the group, with eye-sketches of the more important. In short, we have scattered through this book materials for a much more complete monograph of the Mont Blanc than has ever yet been given to the public.

We pass on to Monte Rosa, the opposite extremity to Mont Blanc of the mountain regions traversed and described by Professor Forbes.

" The vexed question of the comparative height of Mont Blanc and Monte Rosa was undecided before the survey of Von Welden which was published in 1824. * * De Saussure measured not the highest peak, but the third in height now called the Zumsteinspitze. He made it 2430 toises, or 15,540 English feet above the sea.* This was within 200 feet of the height of Mont Blanc; but later and more precise observations all agree in making even the highest point considerably lower. Von Welden finds it to be 14,222 French, or 15,158 English feet, which agrees nearly with the mean of the results of Carlini, Oriani, and Coraboeuf.†

" Monte Rosa is a union of several mountain chains rather than one summit. The map, p. 1, though on a small scale, will give an idea of

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* *Voyages*, § 2135.

† Carlini	2348 toises.
Oriani	2388 "
Von Welden	2370 "
Coraboeuf	2379 "

Brugière, Orographie de l'Europe, p. 208.

their arrangement. From it, or from any map based upon Von Welden's, it will be seen, that a vast inaccessible ridge stretches nearly E. and W., commencing at the Col du Mont Cervin, between Zermatt and Breuil, and terminating in the Cime de la Pisse, to the east of Monte Rosa. This chain includes the Petit Mont Cervin, the Breithorn, and the Lyskamm. Another vast ridge, though a shorter one, meets this nearly at right angles, stretching from Monte Rosa northwards to the Cima di Jazi. It also crosses the chain to the S. so as to form the ridge of the Col d'Ollen, between the Val de Lys and Val Sesia. The union or *knot* formed by these two chains is the locality of the elevated summits properly called Monte Rosa. Of course four cavities or angles are left when the transverse chain meets the longitudinal one. The one of these to the north-eastward, which is the most precipitous, and which, indeed, has been compared by De Saussure to a crater, forms the head of the Val Anzasca, and embosoms the glacier of Macugnaga; the north-western one, vaster, but less precipitous, gives birth to the great glacier of Gorner or Zermatt; the south-western angle contains the glacier of Lys, which descends from the Lyskamm into the valley of Gressonay; the fourth, or south-eastern cavity, is occupied by the head of Val Sesia, and has also extensive though less prominent glaciers.

"Thus Monte Rosa is in ground-plan like a four-rayed star or cross. All the highest summits are ranged along the northern and southern rays, especially the former. The point of union of the rays is not the most elevated, though in some respects it is the most generally commanding top. It is the most conspicuous from the Italian side of the Alps; it has been called by Von Welden 'Signal Kuppe.' It is the fourth in point of height. The three higher lie all immediately north from it; the first in order is the Zumsteinspitze, the highest which has been ascended, which is a snowy blunt summit, mistaken by De Saussure for the highest. Next follows the highest, a sharp rocky obelisk, well seen from the Col d'Erin and from Monte Moro. It is connected with the Zumsteinspitze by a longitudinal very sharp icy ridge, like a house-roof, which on the eastern side descends with appalling rapidity to an abyss which is scarcely equalled for depth and steepness in the Alps. Beyond the highest, or 'Höchste Spitze,' is the second highest, called by Von Welden 'Nord-End,' which, like the last, has never been scaled. The difference of height of these four summits is trifling, amounting to only 34 toises, or little more than 200 feet from the highest to the lowest. Three other summits, of somewhat less height, form the southern arm of the Cross, namely the 'Parrot Spitze,' 'Ludwigshôhe,' and 'Vincent-Pyramide,' the last of which, and also the lowest, was the first ascended of the group."

The Monte Rosa group, no more than that of Mont Blanc, stands on the axis of greatest elevation of the great protuberance of the Alps. Neither limb of the Cross forms a watershed. The stream which waters the Italian Val Anzasca has its sources on the N. side of the ridge that runs from E. and W. The valley of St. Nicholas and the valley of Saas, which lie E. and W. of the northern termination of the ridge, which runs from N. to S., unite at its termination in the valley of the Viège ; and the valleys of Lys and Sesia, which in like manner lie W. and E. of its southern termination, converge in like manner. The Monte Rosa group, like that of Mont Blanc, is placed on one side of the axis of greatest elevation of Alpine protuberance. While, however, Mont Blanc is separated from the chain of heights that run along the axis of greatest elevation by the deep valleys of the two Ferrets and the Allée Blanche, Monte Rosa, from its central knot, throws out two branches at right angles to each other, which extend obliquely towards the axis of greatest elevation.

There are no practicable passes on the western, eastern, or southern limbs of the cross of Monte Rosa. And the accounts of a practicable though difficult pass across the northern one are rather problematical :—

"From the upper part of the glacier of Macugnaga," says Mr. Forbes, "I crossed its main branch to the Châlets de Jazi, at the foot of the mountains of that name.* From thence the view of the precipitous amphitheatre of Monte Rosa and the Saasgrat is very fine. Nearly above those châlets I knew must be the celebrated pass of the Weiss Thor from Zermatt to Macugnaga. The Piedmontese shepherd who occupied the châlet could give me no information respecting it ; and the range appears on this side so absolutely precipitous, that I could hardly convince myself that any track could be found accessible to human feet. It is certain, however, that occasionally precipices are more practicable than they appear at a distance, and generally less vertical ; and, after a very careful examination, I detected a passage of the rocks, and only one, which it seemed possible to pursue. This pass is mentioned by almost every writer on Monte Rosa. De Saussure says that it is very dangerous, but does not say that he conversed with any who had performed it. In Hirzel and Von Welden I find no particular addition from personal knowledge. Engelhardt relates the account of a passage of the Weiss Thor by his guide at Zermatt, no doubt Damater, who has repeatedly assured me that he once passed it, and that it is very dangerous, much more so than the Col d'Erin. Schott states that this pass was formerly more used than at present, and almost exclusively for the purpose of pilgrimage from the Vallais to the Monte Sacro al Varese ; and this corresponds pretty nearly with what I heard from the host Vera at Macugnaga. It is pretty certain that it has been crossed but once in the memory of men now living, and then by a pretty numerous company. I believe that no one in the Val Anzasca has ever passed it."

The axis of greatest elevation of the Alpine protuberance, in the part explored by Professor Forbes, appears to run among the mountain peaks from the great St. Bernard to the St. Gothard. A visit to the former is recorded in the volume now under review ; the author gives no account of a nearer approach to the latter than in his passage across Monte Moro, from the valley of Anzasca to the valley of Saas. The passage of the Great St. Bernard is too familiar to require that we should dwell upon it. We shall, therefore, confine ourselves to Professor Forbes's notices of the less-known passes between the Great St. Bernard and Monte Moro. But before proceeding to the crest of the Alpine mass, a word about its declivities.

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* The Cima di Jazi appears to correspond with the Strablhörner, when seen from Zermatt.

The Italian side of the declivity, it appears from our author's statement, is admirably executed in the government map of the Sardinian territories. It will, therefore, only be necessary to advert to the valleys on the Swiss side, intermediate between the Drance and the Viège.

This group of valleys is situated between the Rhone and the great chain of the Alps; and their openings into the valley of the Rhone are so small and inconspicuous, that they are passed unnoticed by the traveller rolling along in his private carriage, or that of the Simplon courier, almost without perceiving their existence; yet opposite to three well-known stages on that road, Sion, Sierre, and Tourtemagne, three valleys proceed; the Val d'Erin or d'Herens (Eringer Thal), the Val d'Anniviers (Einfischthal), and the Vallée de Tourtemagne (Turtmanthal). Their magnitude and importance are in the order just stated. The Val d'Erin divides into two branches, the valley of Evolena and that of Hérémence, both of which terminate in great glaciers, to wit, the glaciers of Ferpêcle, Arolla, and Lenaret. The Val d'Anniviers divides into the Val de Torrent and the Val de Zinal, with glaciers of the same names. The valley of Tourtemagne is uninhabited except in summer, and terminates in a glacier at the foot of the Weisshorn.

"These valleys have not only been hitherto unfrequented by *tourists*, but are almost unknown even to *travellers* (to make a distinction commonly and not unjustly drawn in Switzerland). . . Even at the time I am describing, although it was past the middle of August, the curé informed us that we were the only strangers who had yet appeared that season at Evolena. A pleasant little work by Fröbel, entitled 'Reise in die weniger bekannten Thäler auf der Nordseite der Penninischen Alpen' (Berlin, 1840), has given the first and only detailed account of them worth notice; and even his visit was one of but a few days, and directed only to the most accessible points. His work is valuable from an improved map which it contains (upon which the index-map in this work is partly founded), and which corrects many of the almost incredible errors of the best executed maps before that time, such as those of Weiss, Keller, and Wörl. . .

"It seems admitted by all who have mentioned these valleys, that their population is of a distinct race from their Swiss neighbours. . . That they lived in a very independent manner, were heathens long after the conversion of their neighbours, became subject to the Bishop of Sion, and were Christianized by his missionaries, is confidently stated. . .

"Their character does not appear to differ much from that of Valaisans, or indeed of the Swiss generally. Their hospitality, according to Fröbel, is seldom disinterested, and an intense love of money predominates in all their transactions. A dollar which once finds its way to Erin is never changed, and never comes forth again. . . Their food is not only coarse, but scanty, and even unwholesome ; their houses and apartments are among the worst in the Alps : cleanliness is not among their virtues. Much of this may be traced to laziness. . . Mules are abundant for country uses, and no man will walk who can ride (even second) upon a mule ; still less will any one carry even a common knapsack without complaint. . .

"The language is barbarous, but I doubt whether it is more so, or more distinctly national than in many other remote valleys of the Alps. . . The name of Evolena is said to mean, in the native dialect, 'tepid water,' and may be derived from a number of beautiful springs which rise from the fallen débris at the foot of the mountain slope immediately behind the town. *Borgne** means brook ; *biegno*, glacier ; and *pigno*, mountain-top, which last Fröbel says is synonymous with the Spanish *penon*, the French *pignon*, and the Gaelic *bein*.

"These valleys, notwithstanding the seeming poverty of their inhabitants, annually export a great deal of produce. Evolena is eight hours distant from Sion. Its neighbourhood presents a very lively and fertile appearance, the valley being broad and well watered, covered with pasture, and studded with barns and châlets up to a great height on both sides ; for, although the secondary ranges, which divide Erin from Hérémence and Anniviers, are of considerable height, and of a fatiguing nature to climb, as those who have passed testify, they are fertile and grassy, affording excellent pasture. . .

"Besides the natural entrances to these valleys from the valley of the Rhone, which, as we have said, are narrow and inconspicuous, there are various passes to and from the higher parts of those valleys. In former times the glaciers were, as we have also seen, undoubtedly much more accessible, and even the pass to Zermatt seems at one time, like the Col du Géant, to have been frequently used. From Hérémence there is said to exist a passage to the glacier of Chermontane, which may have been in the direction we saw in crossing the Col de Fenêtre. There is also a large pass, but not over ice, into the Val de Bagnes, below Mont Pleureur, which M. Studer crossed in 1841. From Anniviers it is very doubtful whether any glacier-pass exists ; but from Tourtemagne, which is a valley inhabited only in summer, it is possible to cross the northern part of the Weisshorn, into the valley of St. Nicholas, above Staldon."

From the Great St. Bernard to the glacier of Allalein, in the valley of Saas, appears, from Professor Forbes's map, to be about 36 English miles in a direct horizontal line in the direction of E.N.E. This is nearly the direction of the axis of greatest elevation of this part of Alpine protuberance. East of the Great St. Bernard, and west of the glacier, five principal valleys furrow the N.W. declivity:—The Val de Bagnes, a bifurcation of the Drance valley; the Val d'Erin, with its side valley of Hérémence; the Val d'Anniviers, with its two upper valleys; the Vallée de Tourtemagne; and the valley of Visp, with its two upper valleys of St. Nicholas and Saas. The valleys on the S.E. side are the Val Pellina and the Val Tourmanche, affluents of the Doire, the Val d'Ayas, Val Lys, Val Sesia, and Val Anzasca. The Val d'Ayas, Val de Lys, and Val Sesia, descend from the S. side of the ridge of the Monte Rosa group that runs E. and W.: they have no connexion with the valleys on the opposite side by cols or passes. A col affords a passage across Monte Moro, from the upper valley of Anzasca, in the N.E. angle of the Monte Rosa cross, to the valley of Saas; and it is asserted that another col affords a passage from the upper Anzasca, across the N. limb of Monte Rosa, to Zermatt, in the valley of St. Nicholas. In the N.W. angle of the Monte Rosa cross is an immense accumulation of glaciers, from which it is said to be possible to pass E. to Macugnaga by the Weiss Thor, and W. to the upper valley of the Tourmanche, by the Col de St. Théodule. These glaciers descend to the valley of St. Nicholas, by the Glacier de Gorner and the Glacier de Finelen, and extend to the N. along the Saasgrat. To the N.W. of this accumulation of glaciers, and N.W. of the Great St. Bernard, the broad tract of the Pennine Alps is covered with a number of glaciers lying around the bases of the principal peaks, and communicating by cols with the upper valleys of both declivities. It is to Professor Forbes's adventurous excursions in this desert region that we are indebted for most of what is entirely new in his geographical information. The following retrospect will convey some idea of the disposition of the heights on this part of the ridge:—

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* Scotticè, 'burn.'—Ed.

> "Before leaving this part of our description, I must say one word on the geography of this part of the chain. By Wörl's map, or that of Keller, until the edition of 1842, it would appear impossible that such a pass should exist as that which I am now describing [from Evolena to Zermatt.] The chain of the Alps is represented as turning from the Mont Cervin abruptly to the N.W.—as including the Dent Blanche, at the southern foot of which the Val Pelline is made to take its rise (!), and then as bending back again to the glacier of Arolla. Since the Dent Blanche is rightly placed between the glacier of Ferpêcle and that of the Torrent-thal, it evidently would have been impossible to reach Zermatt from Evolena without crossing into Italy, and recrossing near Mont Cervin. Now, without detailing other varieties of error, the reality is, that the main chain of Alps is here well defined, and nearly straight, extending from Mont Cervin, through the Dent d'Erin, to the nameless summits south of Mont Colon, and at the true head of Val Pelline or Biona. The whole north face of Mont Cervin and the Dent d'Erin is a united and inaccessible precipice, which falls into the glacier

of Zmutt, and which extends far to the westward of both, not rising (as even Fröbel inaccurately represents it) immediately behind the Mont Cervin, but in the great ice-mass to the westward of the Dent d'Erin. Now, just where the glacier of Zmutt takes its rise is the commencement of a great lateral chain, on so stupendous a scale as to create little surprise that it has often been mistaken for the great chain. The glacier of Ferpêcle descends from its north-western flank, where it forms the Col d'Erin and the Stockhorn, upon which we conceive ourselves stationed. It then expands itself into the mass of the Dent Blanche, which sends forth the ramifications of the Dents d'Abricolla and Zatalane, which separate the valleys of Erin and Anniviers. From the Dent Blanche the chain takes an easterly direction, forming the summit called Moming in Erin, Triftenhorn at Zermatt (where the Dent Blanche is called Hovenghorn), which separates the valley of Zinal and Zmutt. This part of the chain appeared to me quite impassable. Then follow a range of peaks called Gabelhörner, which continue the chain in a north-easterly direction, parallel to the valley of St. Nicholas, until we reach the culminating point of the Weisshorn, a seemingly inaccessible peak, of 14,812 English feet, which is often mistaken for Monte Rosa, especially from the pass of the Gemmi, whence it and other parts of the chain just mentioned have been elaborately figured in Von Welden's work as the actual chain of Monte Rosa, and received specific names accordingly, although the real Monte Rosa is some thirty miles distant, and wholly concealed."

Some important hints are given respecting the structure of these mountains :—

"During this descent I had an opportunity of examining closely the structure of Mont Cervin, on the N.W. side, which probably no mineralogist has had before. There seems no reason to doubt that it is entirely composed of metamorphic secondary rocks. The lower part is of the system of *green slates*, which abound in this part of the Alps, and which here pass into serpentine and gabbro, as the moraines testify; the higher part of grey and *white* slates, remarkably contorted. The middle strata of Mont Cervin appear to form by their prolongation the Stockhi, on which I stood; and the Col d'Erin and Stockhorn are composed of a repetition of the green slate, which contains so much felspar that it may be called gneiss.

"The highest part of Monte Rosa, judging from specimens brought from the last accessible point, is mica-slate. The whole system of Monte Rosa, as already said, rises to the east, and the first regularly crystalline rocks we meet with are near the Pizzo Bianco, above Macugnaga. With respect to the age of these various rocks, few geologists are yet disposed to decide with much confidence. I have already discovered that the division between the true primitive gneiss and mica-slate, and the rocks of the same mineral character, which may be traced continuously into beds containing lias fossils, seems to be an arbitrary distinction, and one upon which no two observers could exactly agree. The age of the feldspathic and micaceous slaty rocks may be considered as open to discussion. The others, namely the grey and green slates which I have described, are included by Mr. Studer in the general name of *Flysch*, a widely spread formation in Switzerland, but where superposition is too irregular and uncertain, and the series of formations too imperfect to afford any clue to its age, whilst the one or two fossils which have been found in it seem to point to an age newer than the lias, and older than the medium chalk formation. What an overturn of all ancient ideas in geology, to find a pinnacle of 15,000 feet high, sharp as a pyramid, and with perpendicular precipices of thousands of feet on every hand, to be a representative of the older chalk formation! and what a difficulty to conceive the nature of a convulsion (even with unlimited power) which could produce a configuration like the Mont Cervin rising from the glacier of Zmutt."

It is to be hoped that, the ground having been fairly broken for an improved geography of the Alps, that region will not much longer be allowed to remain a reproach to modern geographical knowledge. It would have been pleasing to anticipate that the author of the work we have been reviewing might have been able to carry on the researches he has so admirably begun, but of this it is with deep regret we learn there is no immediate prospect. He is at present in such a delicate state of health—owing in great part, there is reason to apprehend, to his exertions and exposure in the inclement regions of the Alps—as to have been obliged to seek a milder climate than his native island affords, and to intermit the discharge of his professional duties during the present winter. May the change prove beneficial! and be the means of restoring to his favourite pursuits one who, with ardent zeal in the pursuit of knowledge, combines high qualities for attaining it and a rare degree of amiability, purity, and elevation of character.

II.—*Researches in Asia Minor, Pontus, and Armenia; with some account of their Antiquities and Geology.* By WILLIAM J. HAMILTON, Secretary to the Geological Society. London. Murray, 1842. [By the Editor.]

AMONG the geographical works entitled by their intrinsic merit to analysis, now lying on our table, Mr. Hamilton's appears to be classed most naturally with the other two selected for notice in the present Part of the Journal. Taken together, the whole three give evidence of a promising spirit of enterprise among the geographers of Great Britain, combined in two of the instances, in a rare degree, with judicious pains-taking. The circumstances attendant on the publication of Mr. Johnston's Atlas indicate an awakening interest in geographical research in a